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US Army Corps
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The U.S. Cruise Industry – Evaluation of National Economic Development Benefits

October 1999

IWR Report 99-R-8

**U.S. Army Institute for Water Resources
Navigation Analysis Program**

The U.S. Army Corps of Engineers Institute for Water Resources (CEWRC-IWR) is part of the Water Resources Support Center in Alexandria, VA. The Institute was created in 1969 to analyze and anticipate changing water resources management conditions, and to develop planning methods and analytical tools to address economic, social, institutional and environmental needs in water resources planning and policy. Since its inception, IWR has been a leader in the development of tools and strategies needed to plan and execute the Corps water resources program.

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- National Level Technical Support to HQUSACE
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For further information related to the program, please contact:

Robert A. Pietrowsky
Chief, Navigation Analysis Division
(703) 428-6240

Kyle E. Schilling
Director, Institute for Water Resources
(703) 428-8015

Department of the Army
Corps of Engineers
Water Resources Support Center
Casey Building, 7701 Telegraph Road
Alexandria, VA 22315-3868

Reports may be ordered by writing (above address) or contacting Arlene Nurthen, IWR Publications, by fax at (703) 428-8435, or E-mail at "ARLENE.J.NURTHEN@USACE.ARMY.MIL".

THE U.S. CRUISE INDUSTRY- EVALUATION OF NATIONAL ECONOMIC DEVELOPMENT BENEFITS

FINAL REPORT

A Report Prepared by:

**U.S. Army Corps of Engineers
Institute for Water Resources
Casey Building
7701 Telegraph Road
Alexandria, Virginia 22315**

October 1999

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Views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other official documentation.

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A Corps of Engineers working group provided valuable input into the study. Study members of the working group included:

Name	Organization
Lillian Almodovar	CECW-PD
Gloria R. Appell	CESWG-PL-R
Robert M. Daniel	CECW-PD
Jim K. Fredericks	CENWP-PM-FE
Michael R. Krouse	CEWRC-IWR-R
Patricia L. Mutschler	CENAB-PL-PR
Frank R. Reynolds	CESAW-EP-PL
Dennis P. Robinson	CEWRC-IWR-N
William J. Hansen	CEWRC-IWR-R

Review and comments were provided by Mr. Phillip J. Thorpe, Ms. Christine M. Brayman, and Mr. Robert A. Pietrowsky of CEWRC-IWR-N. The report was prepared for publication by Mr. Akapelwa Imwiko of Planning and Management Consultants, Ltd. of Carbondale, IL.

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EXECUTIVE SUMMARY

The modern cruise industry began in the late 1960's, when year-round Caribbean cruises began operating out of Miami. Until that time, the world cruise fleet consisted of very old ships, most of them originally constructed for trans-Atlantic crossings. Currently, Caribbean cruises dominate the industry with most larger cruise ships positioned in this market. Other popular cruise destinations include Alaska, the Mediterranean, western Mexico, and Northern Europe.

At the time of this study, the world cruise ship fleet consisted of about 250 vessels. About 200 of those vessels were deep draft. In addition to these vessels, 37 deep draft vessels were on order. Of these ships, 87 of the existing vessels and 24 of the vessels on order use (or will use) U.S. ports. The existing and on order ships were jointly analyzed, for a total of 111 deep draft cruise ships in the U.S. fleet, and 242 deep draft cruise ships in the world fleet.

Vessel sizes and the number of people taking cruises have been steadily increasing since the 1980's when the cruise industry began a shipbuilding spree. Most vessels constructed before 1980 were less than 40,000 gross tons (GT). The largest cruise ship currently in the fleet is 109,000 GT with a capacity of 3,360 passengers. Even larger vessels are currently on order. The annual passenger growth rate equaled almost 8 percent from 1980 to 1997 while passenger capacity increased 7 percent. Between 1997 and 2002, passenger capacity is projected to increase 8.1 percent per year.

A typical cruise ship is 70,000 GT, drafts under 26 feet, and carries about 2,000 passengers. It is based in Southern Florida, and sails late every Saturday afternoon to the Caribbean, returning to its homeport on the following Saturday morning. The average fare for a cruise is about \$225 per person per passenger per day, although many passengers on a typical cruise will pay more. The fare includes nearly all the major services offered by the cruise ships, including shipboard accommodations, food and snacks, entertainment, activities and port charges. Airfare to and from the ship's homeport is often included in the cruise fare, and includes transportation and baggage handling between the airport and the ship. Aspects of cruise operations that can significantly affect National Economic Development (NED) benefits include itinerary planning and port selection, contingency planning, operating costs and revenue generation.

NED benefits associated with cruise ships from harbor improvements could come from three sources: 1) existing vessels using a harbor under without-project conditions operate more efficiently in that same harbor under with-project conditions; 2) vessels using one harbor under without-project conditions transfer to the improved harbor under with-project conditions; and 3) new vessels (larger, with more amenities) begin using a harbor under with-project conditions that they did not use under without-project conditions. Benefits could accrue to both vessel operators and passengers under each of the three scenarios. Benefits accruing to both passengers and operators are categorized as commercial navigation benefits

Benefits to operators could accrue from decreases in vessel operating costs, landside costs (meals, hotels, transportation, staff) and/or payments to passengers (refunds and/or free

cruises). Benefits resulting from decreases in costs can be calculated using standard techniques from *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G)*. The calculation of benefits resulting from decreases in payments to passengers should be coordinated with CECW-PD. Operators could also experience increases in producer surplus (profits) from higher fares, new users, and/or higher onboard revenue. Producer surplus benefits can be determined by calculating the additional profits gained under with-project conditions.

Benefits to passengers could accrue from changes in the value of the recreational experience. The value of the experience could increase as a result of a reduction in canceled port calls and shore excursions, the routing of cruise vessels through with-project condition ports, or the use of newer, larger vessels with more amenities than the older, smaller ships. Changes in the value of the experience should be calculated using the contingent value method or conjoint analysis. Passengers could also experience decreases in the opportunity costs of time and out-of-pocket costs incurred due to delays or changes in the costs of transportation to and from the port. Standard techniques can be used to calculate benefits from decreases in the opportunity costs of time and out-of-pocket costs for passengers.

Navigation improvements are not likely to result in significant benefits to the cruise industry. This is because cruise ship operators do not experience significant operating inefficiencies or severe service disruptions in most U.S. ports. When disruptions do occur, they are usually not caused by channel constraints since cruise vessels have shallower drafts than most other commercial vessels. Inefficiencies and disruptions that do occur in cruise operations are generally not caused by problems that USACE navigation projects can solve.

I. INTRODUCTION

The *Water Resources Development Act of 1996* (Public Law 104-303 – October 12, 1996) directs the U.S. Army Corps of Engineers to categorize all benefits generated by cruise ships as commercial navigation benefits. Benefits of navigation improvements affecting cruise ships arise from more efficient ship operations and increased tourism or enhanced tourism experience. Prior to the 1996 WRDA efficiency improvement was classified as commercial navigation and improved tourism was classified as recreation. Categorization of benefit matters because the Corps considers commercial navigation one of its high priority missions.

As a result of the interest in the benefits generated by cruise ships, this report was prepared. The purpose of this report is to provide information on cruise ship operating practices and costs, revenue structures, and any other relevant factors that pertain to the conduct of National Economic Development (NED) deep draft benefit-cost analysis. It also summarizes factors of particular relevance for NED analysis and suggests alternative ways to measure cruise ship benefits.

To complete these tasks, information on the U.S. cruise industry was obtained from publications, the Internet and interviews with cruise line officials. A consultant, Maritime Strategies International (MSI), Ltd., conducted the interviews with officials from five cruise lines. The information was analyzed and methods for calculating the NED benefits from cruise ships were developed.

Section I of the report provides an introduction of the subject matter. Section II provides background information on the U.S. cruise industry, including its history and a description of a "typical" cruise. Information on the world cruise fleet is found in Section III. Aspects of cruise operations that can significantly affect benefits are described in Section IV. Section V describes the potential NED benefits associated with cruise ships, while Section VI summarizes the issues presented and the benefit categories.

II. CRUISE INDUSTRY BACKGROUND

The modern cruise industry began in the late 1960's, when year-round Caribbean cruises began operating out of Miami. Until that time, the world cruise fleet consisted of very old ships, most of them originally constructed for trans-Atlantic crossings. Within a few years, modern cruise ships constructed specifically for Caribbean cruising dominated the industry. Instead of offering variable routes and schedules targeted to the world upper class, the Southern Florida-based vessels promoted weekly or biweekly sailings targeted to the United States market. By 1974, Miami was the largest passenger port in the United States, surpassing New York City. During that same period, the cruise industry began building in Alaska and along Mexico's West Coast. The industry got its biggest boost in 1977, when the television show, *The Love Boat*, began airing (Dickinson and Vladimir, 1997).

The number of passengers carried by the North American cruise fleet grew steadily from 1980, when about 1.4 million passengers took cruises, to 1993, when about 4.5 million passengers cruised. In 1994 and 1995, passenger traffic decreased slightly, then increased in 1996 and 1997. By then, the worldwide cruise industry served more than six million passengers, with about five million carried by the North American-based fleet. The annual passenger growth rate equaled almost 8 percent from 1980 to 1997 while passenger capacity increased 7 percent. Between 1997 and 2002, passenger capacity is projected to increase 8.1 percent per year (*The Cruise Industry: An Overview*, Cruise Lines International Association (CLIA), August 1998).

Beginning in the early 1980's the cruise industry began a shipbuilding spree that continues today. Additional capacity was needed to meet the demand from the increased number of passengers. In addition, brand new vessels encouraged more passengers to begin cruising or to cruise more often. Vessel sizes have been steadily increasing since the building boom started. Most vessels constructed before 1980 were less than 40,000 gross tons (GT)¹. (The exceptions were the cruise liners constructed for trans-Atlantic crossings. The liners were among the longest and deepest drafting cruise vessels of their time, with relatively narrow beams). The largest cruise ship currently in the fleet is 109,000 GT with a capacity of 3,360 passengers. Even larger vessels are on order.

Most of the mega-ships are positioned in the Caribbean market, which remains the most popular cruise destination. The U.S. Virgin Islands, for example, receives more than one million passengers per year. The next most popular destinations are Alaska and the Mediterranean, with the number two destination dependent upon the source of the information. Other important markets are transcanal (routes through the Panama Canal), western Mexico, and northern Europe (*Cruise Industry News: 1997 Annual*, Cruise Industry News, 1997).

Most cruises are from six to eight days long, with the average length being six and a half days with three ports of call. However, the fastest growing category is for two to five day cruises. More vessels are offering two trips per week, one three-day and one four-day, reflecting Americans' shorter vacation patterns (*The Cruise Industry: An Overview*, Cruise Lines International Association, August 1998).

A Typical Cruise Experience

A typical cruise ship is 70,000 GT, drafts under 26 feet, and carries about 2,000 passengers. It is based in Southern Florida, and sails late every Saturday afternoon to the Caribbean, returning to its homeport on the following Saturday morning. The average fare for a cruise is about \$225 per person per passenger per day, although many passengers on this typical cruise will pay more. The fare includes nearly all the major services offered by the cruise ships, including shipboard accommodations, food and snacks, entertainment, activities and port

¹A gross ton is how the size of cruise ships is measured. One gross ton equals 100 cubic feet of enclosed revenue-earning space (volume) (Dickinson and Vladimir, 1997).

charges. Airfare to and from the ship's homeport is often included in the cruise fare, and includes transportation and baggage handling between the airport and the ship.

A typical stateroom, or cabin, is much smaller than a hotel room of the same class and is designed for two people. Sometimes staterooms include upper fold-down berths or a roll-away bed to accommodate up to five people. (Capacity of a cruise vessel is generally measured using double occupancy, or two passengers per cabin. Cruise vessels can have occupancy rates greater than 100 percent, if more than an average of two people per cabin are on board. A "total capacity" figure includes the full use of the additional bunks.) An "outside cabin" has a view of the ocean, often through a picture window. Newer cruise ships are being constructed with more outside cabins, and include staterooms with private verandas.

Meals are highlights of the cruise experience, with the food available on a typical cruise being renowned for both quality and quantity. Passengers are generally assigned a table at one of the main dining rooms, where they will sit for the duration of the cruise. Two seatings per day are offered for each meal, and passengers are also assigned to either the early or late seating. However, other options for dining are available. Informal choices are often available throughout the day, such as continental breakfast in the cabin, midmorning coffee and pastries on the deck, sandwiches poolside at lunch, afternoon tea, and a midnight buffet. Many cruise ships also have small, informal dining areas such as cafes, delis, or pizza parlors. In addition, twenty-four hour room service is generally available. All food, but usually not beverages, is generally included in the cruise fare.

Entertainment on a cruise ship is varied, and runs the gamut from original Las Vegas or Broadway-style shows to dance bands, stand-up acts, and passenger talent shows. These shows are often held in a huge show lounge seating more than 1,000 people, with state-of-the-art audio and video equipment. In addition, cruise vessels have smaller lounges and bars, often with live entertainers, discos, and at least one casino on board. Organized activities include theme parties, classes, demonstrations, lectures, contests, and sports. A typical cruise ship will also have a fitness center with exercise machines, classes, and trainers. For children, youth and teen programs, play areas, and arcades are provided. Nearly all entertainment and activities are included in the cruise fare. Exceptions include the casino, shopping and personal services such as photography development, hair styling, and spa services.

Besides the onboard activities, cruise vessels visit an average of three destinations per trip. On a seven-night trip, four port calls would be typical, including one at a facility owned by the cruise line. For each port-of-call, several planned shore excursions are available. The excursions may be tours of the city, countryside, or historic sites. They may be activity-based, such as shopping or windsurfing. The cost of optional shore excursions is usually not included in the base fare.

III. CRUISE FLEET

At the time of this study, the world cruise ship fleet consisted of about 250 vessels. About 200 of those vessels were deep draft, defined for this study as vessels with design drafts equal to or greater than four meters (13.1 feet). In addition to the existing vessels, 37 deep draft vessels were on order. Of these ships, 87 of the existing vessels and 24 of the vessels on order are primarily for calling ports in the U.S. market.² The existing and on order ships were jointly analyzed, for a total of 111 deep draft cruise ships in the fleet calling U.S. ports, and 242 deep draft cruise ships in the world fleet. Due to future withdrawals of vessels from the fleet, it is not anticipated that all the existing vessels will remain in the fleet as new vessels are delivered. Table 1 presents the number of deep and shallow draft cruise vessels, both existing and on order, for ships calling U.S. ports and those not calling U.S. ports (rest of the world).

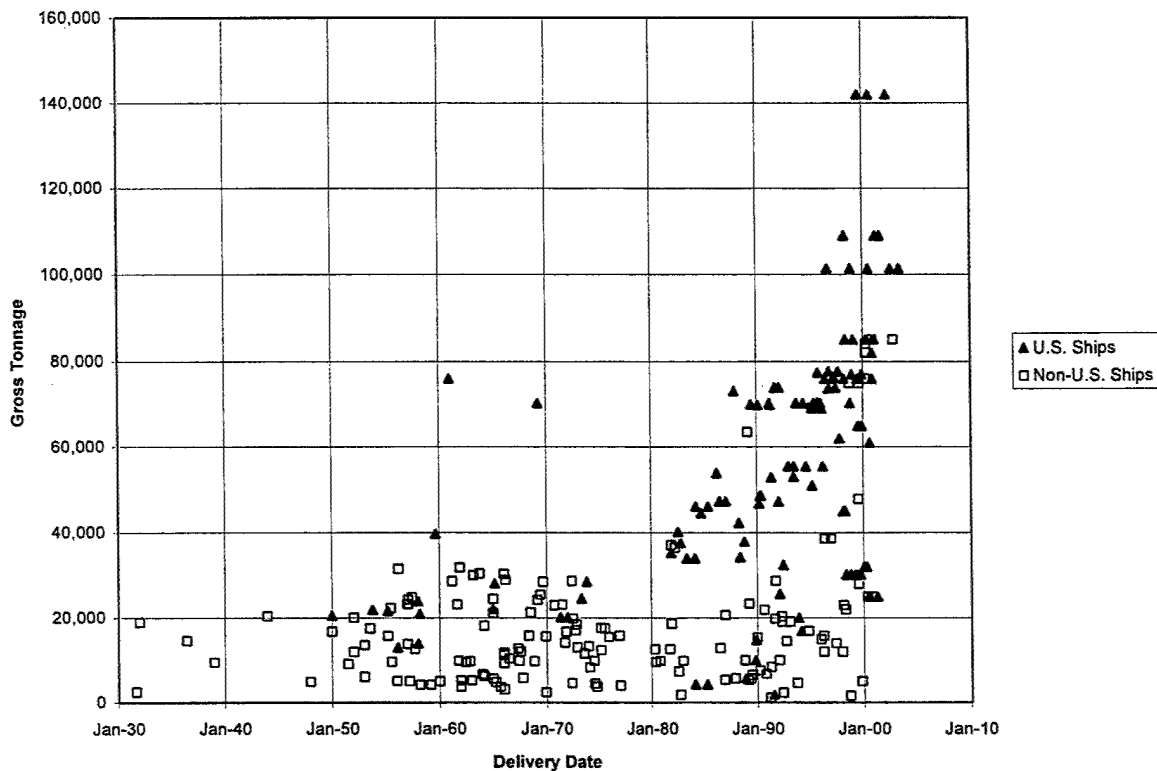
Table 1
Number of Cruise Ships

		Shallow Draft	Deep Draft	Total
Ships calling U.S. Ports	Existing	17	87	104
	On Order	0	24	24
	Total	17	111	128
Ships not calling U.S. Ports	Existing	24	118	142
	On Order	5	13	18
	Total	29	131	160
World Fleet	Existing	41	205	246
	On Order	5	37	42
	Total	46	242	288

The fleet calling U.S. ports has larger, newer vessels than the rest of the world fleet, which is shown in Figure 1, World Cruise Ship Fleet: Vessel Size and Age. Note also that since the early 1980's, cruise ships have become increasingly larger.

Fleet characteristics were derived using information from the *Fairplay PC Ships Register* (Fairplay, April 1997), *Fairplay Newbuildings* (Fairplay, August 21, 1997), and *International Guide to the Cruise Industry - 1998 Annual* (Cruise Industry News, 1998). Information was gathered for all cruise vessels in the world fleet that are either currently operating (delivered) or

²Information on the cruise ships that serve the U.S. could not be easily obtained. However, Cruise Industry News (CIN) tracks ships that are marketed primarily in North America. Nearly all of CIN's North American fleet call at U.S. ports. Using CIN's North American fleet and information for each ship on scheduled routes and ports-of-call, a U.S. fleet was derived. The U.S. fleet is mainly *not* U.S. flag vessel.



**World Cruise Ship Fleet
Vessel Size and Age
Figure 1**

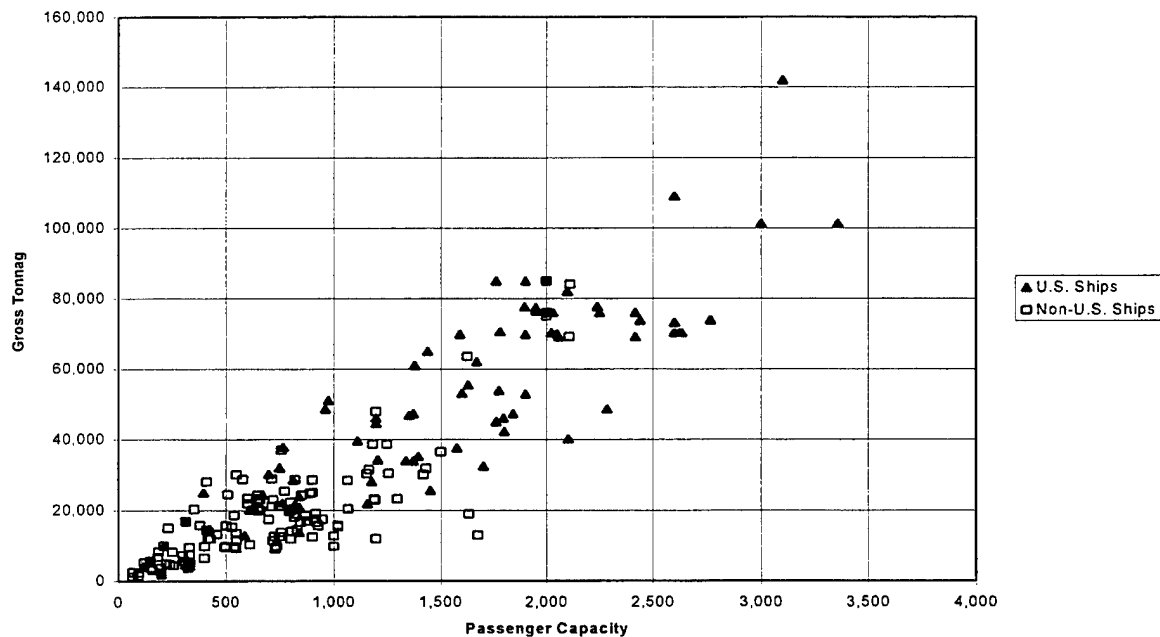
under contract for construction (on order). A determination was made for the purposes of this study of the vessels that are deep draft. For this study, only deep draft vessels were analyzed in detail.

Table 2 lists vessel characteristics for the U.S. calling and non-U.S. calling fleets. All characteristics except age, are based on delivered and on order ships. For age, only delivered ships are considered. Note that some characteristics are not available for all vessels. In particular, length, draft, and beam are not available for many ships on order.

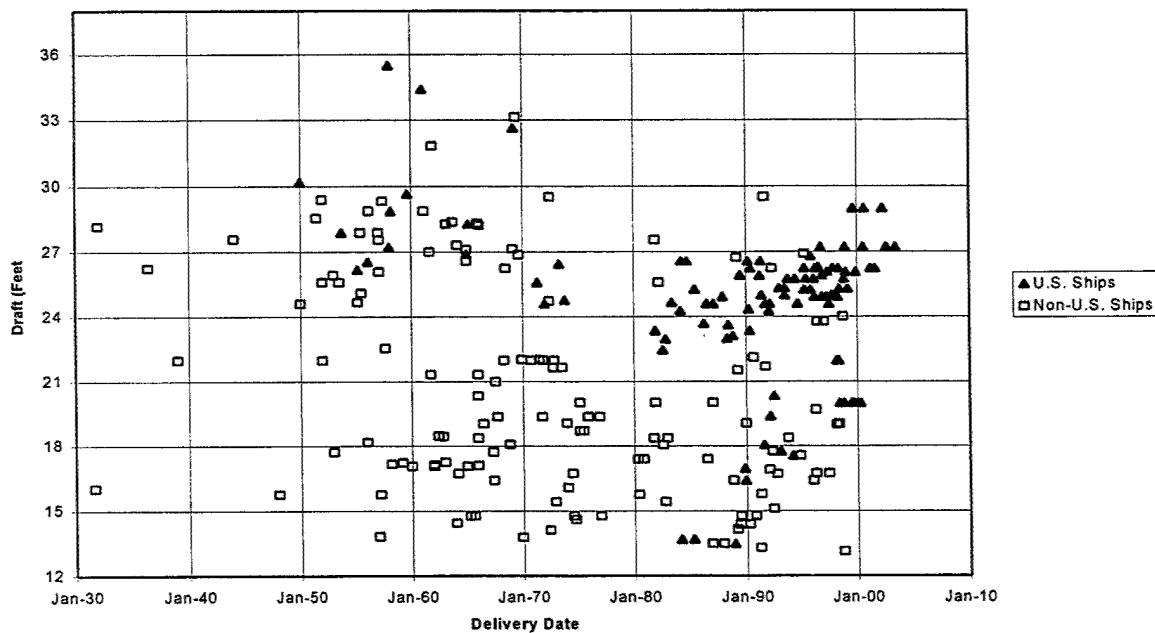
Figure 2 shows cruise vessel passenger capacity by gross tonnage. This figure shows a strong relationship between vessel size and passenger capacity. Figure 3 shows the relationship between vessel draft and age. All cruise vessels less than thirty years old, including the mega-cruise ships under construction for the U.S. market, have design drafts less than nine meters, or about twenty-nine feet.

Table 2
Cruise Ship Characteristics

Vessel Characteristic	U.S. Calling Ships			Non-U.S. Calling Ships		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Gross Tons	1,800	142,000	56,023	1,189	85,000	18,638
Age (years)	0	47	14	0	66	27
Passengers	116	3,360	1,664	67	2,112	720
Length - m	105 (344)	316 (1,036)	226 (741)	72 (236)	268 (879)	154 (505)
Beam - m (ft)	15 (49)	48 (157)	30 (98)	12 (39)	33 (108)	21 (69)
Draft - m (ft)	4 (13)	11 (35)	8 (26)	4 (13)	10 (33)	6 (20)



World Cruise Ship Fleet
Vessel Size and Passenger Capacity
Figure 2



**World Cruise Ship Fleet
Vessel Draft and Age
Figure 3**

Market Segments

Most cruise lines focus on a certain market. Cruise Industry News categorizes the market segments as budget, contemporary, premium, luxury, and niche. Each type of market is characterized by the type and age of the ships used, the level of service provided, and the amenities offered. The descriptions of the market segments that follow are from the *International Guide to the Cruise Industry - 1998 Annual* (Cruise Industry News, 1998).

The budget segment includes the least expensive cruise ships, with rates per person per day (PPPD) starting as low as \$80. The ships are usually smaller and older and offer fewer amenities and less entertainment than other vessels. However, they often call at unusual ports-of-call, and sometimes offer good food and fine service.

The contemporary segment is the largest market with the most ships and capacity. The ships in this segment are generally new, medium-sized to very large. The average cruise length is seven or fewer days, and rates are less than \$300 PPPD. Passengers of all ages and income categories, especially first-time cruisers, go on contemporary ships.

The premium segment offers excellent service and fine food, and attracts experienced travelers and repeat cruisers. The passengers are often older and more affluent than on other

ships. The length of cruises ranges from seven to 14 days, and rates are usually between \$200 and \$400 PPPD. The ships are medium-sized to large, and generally new.

The luxury segment has small or medium-size ships with high space ratios. The ships are usually new, and sail worldwide on upscale cruises lasting seven days or longer. The rates PPPD range from \$300 to more than \$800.

The niche or specialty segment includes all other types of service that do not fit in the other categories, including sailing vessels, exploration or "soft adventure" cruises, and riverboat cruises. Luxury sailing vessels are usually modern, and offer fine food and service on cruises that average seven days in length. The rates PPPD range between \$200 and \$400. The exploration cruises usually last ten days or longer. These ships have fewer amenities than typical cruise ships, with the emphasis of the cruise on the learning experience.

Cruise Lines

Like many industries worldwide, the cruise line industry has been consolidating. The world cruise industry is now dominated by three companies: Carnival Corporation, Royal Caribbean International (RCI), and P&O (Peninsular and Oriental Steam Navigation Company). Carnival and RCI are both U.S.-based firms. Although P&O is based in Great Britain, its largest subsidiary, Princess Cruises, is U.S.-based.

Carnival Corporation owns Carnival Cruise Lines, Holland America Line, and Windstar Cruises. It also has ownership interests in Cunard Line, Seabourn Cruise Line, Costa Cruises, and Airtours (Sun Cruises). In 1998, these seven cruise lines operated 43 cruise ships. Carnival Cruise Lines has eleven ships and four on order, sailing in the Caribbean, Bahamas, Mexican Riviera, Alaska, Hawaii, and the Panama Canal. Holland America Line has nine ships and two on order. It sails seasonally in Alaska, and year-round in the Caribbean and worldwide. Windstar Cruises has four small, luxurious ships that sail in the Caribbean and the Mediterranean. Carnival has 50 percent ownership in Seaborne Cruise Line, which has three small, very luxurious ships that sail worldwide. Cunard, which sails five vessels worldwide, and is owned by Carnival Corporation and a group of Norwegians, will be merged with Seabourn. Carnival Corporation also holds 50 percent ownership of Costa Crociere of Genoa. Costa Cruise Lines, a subsidiary of Costa Crociere, is Europe's largest cruise operator and has eight ships that sail worldwide. Carnival also has 29 percent ownership in Airtours (Sun Cruises), one of the largest tour operators in Europe, which has three cruise ships.

Royal Caribbean International (RCI) operates twelve cruise ships, and has four on order, including three 142,000-ton vessels due to be delivered in 1999, 2000, and 2002. It currently has about 23,000 berths. The ships sail year-round in the Caribbean, Mediterranean, Far East, and on the West Coast. They also seasonally sail through the Panama Canal, in Alaska, Europe, and to Bermuda. RCI also owns Celebrity Cruises, which operates five vessels in Alaska, Bermuda, and the Caribbean, and has two on order.

The third large cruise company is P&O. Cruise lines owned by P&O include princess Cruises, P&O Cruises (UK), Swan Hellenic, and P&O Holidays (Australia). U.S. based Princess Cruises operates nine ships and has three on order. With about 12,000 berths, Princess cruise ships sail worldwide. P&O Cruises (UK) is the leading British operator with three ships. Swan Hellenic is a niche cruise line with one vessel that serves mainly British passengers. P&O Holidays (Australia) operates one vessel.

Table 3 lists all cruise lines operating deep draft vessels in the U.S. market in 1998, including those discussed above. The table includes the number of ships (delivered and on order), number of passengers (pax), and routes for vessels operating in the U.S. for each line. The basis for the cruise lines and ships that serve the U.S. is from *Cruise Industry News* or *Fielding's CruiseFinder* (on the World Wide Web), as are the routes. The number of ships was derived from *Cruise Industry News* and *Fairplay*. The number of passengers is from *Cruise Industry News*, the *Fairplay Ships Register*, or *Fielding's CruiseFinder*.

Table 3
Cruise Lines Operating in the U.S.

Cruise Line	Ships	Pax.	Segment	Routes
American Hawaii Cruises	1	802	Niche	Hawaii inter-island
Cape Canaveral Cruise Line	1	588	Budget	Bahama
Carnival Cruise Line	15	37,300	Contemp.	Caribbean, West Coast, Alaska
Celebrity Cruises	6	10,061	Premium	Worldwide
Club Med	2	835	Lux. Sailing	Caribbean, Mediterranean, French Polynesia
Commodore Cruise Line	1	840	Budget	Caribbean
Costa Cruise Line	8	10,330	Cont./Prem.	Worldwide
Crystal Cruises	2	1,935	Luxury	Worldwide
Cunard Line	5	3,697	Prem./Lux.	Worldwide
Disney Cruise Line	2	5,200	Contemp.	Bahama and private island
Holland America Line	11	16,665	Premium	Alaska and Caribbean
Majesty Cruise Lines	2	2,500	Contemp.	Caribbean, Alaska, Boston to Bermuda
Norwegian Cruise Line	7	10,313	Contemp.	Europe, South America, Caribbean, Alaska
Premier Cruises	3	2,841	Budget	Caribbean, East Coast, transcanal
Princess Cruises	12	19,585	Cont./Prem.	Worldwide
Regal Cruises	1	1,160	Budget	Caribbean, South America, East Coast
Renaissance Cruises	2	1,500	Luxury	Worldwide
Royal Caribbean Intl.	16	38,453	Cont./Prem.	Worldwide
Seabourn Cruise Line	3	636	Luxury	Worldwide
Silversea Cruises	4	1,408	Luxury	Worldwide

Table 3
Cruise Lines Operating in the U.S.

Cruise Line	Ships	Pax.	Segment	Routes
Special Expeditions	1	160	Niche	Worldwide
Star Clippers	2	400	Lux. Sailing	Caribbean, Far East, Mediterranean
Windstar Cruises	3	450	Lux. Sailing	Caribbean and Mediterranean
World Explorer Cruises	1	840	Niche	Alaska, Latin America, Western Caribbean
Total	111	168,499		

Passengers

Every two years since 1986, the Cruise Line International Association (CLIA) has conducted a cruise market profile study that investigates the cruise market potential, perceptions about cruising, and people's intentions to cruise. The most recent survey for which information is available is the *1996 Market Profile & Cruise Prospect Segmentation Study* (CLIA, 1996).

Cruise passengers ("cruisers") represent a wide market. People of all ages and incomes take cruises. On average, cruisers are older with fewer children living at home, more educated, and have incomes higher than the target market as a whole. Table 4 presents demographic information on cruisers and the cruise industry's target market - individuals 25 years or older with a household income of \$20,000 or more.

People cruise for many reasons. According to CLIA's *Press Presentation: Cruiser Segmentation Study*, September 1995, cruisers believe that the key benefits of cruising are the ease of visiting different places, always having something to do or see, and its reasonable cost, given the value. Many people appreciate visiting several locations without the logistic hassles of arranging transportation, lodging and sightseeing, and repeatedly packing and unpacking. The all-inclusive price is also a selling point for the industry. In selecting a particular cruise, the most important factor is the destination. Also important are the costs, the time of year, and the cruise line or ship. According to CLIA surveys, most people are highly satisfied with their cruise experience. Cruises tend to meet or exceed expectations, and compare favorably with other kinds of vacations.

Table 4
Cruiser Demographics

		Ever Cruised	Past Five Years Cruisers	Target Population
Gender	Male	46%	47%	50%
	Female	54%	53%	50%
Age	25 - Under 40	32%	34%	42%
	40 - 59	36%	35%	40%
	60+	32%	31%	18%
	Average	50	49	45
	Median	48	48	43
Marital Status	Married	74%	75%	73%
	Not Married	26%	25%	27%
Household Composition	Children Under 18	33%	32%	43%
	Adults Only	67%	68%	57%
	Average Household Size	3	3	3
	Median Household Size	2	2	3
Education	Some College or Less	48%	48%	55%
	College Graduate or	52%	52%	45%
Household Income	Under \$40,000	31%	26%	40%
	\$40,000 - \$59,999	32%	33%	33%
	\$60,000 - \$99,999	23%	25%	19%
	\$100,000 +	14%	16%	8%
	Average	\$62,575	\$66,130	\$54,743
	Median	\$50,748	\$54,381	\$45,964

Cruise Ports

The busiest cruise ports in the United States are found on Florida's Atlantic coast, and serve the Caribbean and Bermuda cruise market. Miami is the busiest cruise port in the world, with more than three million passengers per year embarking and disembarking. Port Everglades and Port Canaveral, also in Florida, are the second and forth largest cruise ports in North America. San Juan, Puerto Rico, is the third largest. Although the Alaskan cruise market is very large (either the second or third largest in the world, depending upon how the numbers are

counted), it is not served by a U.S. port. Nearly all passengers taking Alaskan cruises embark and disembark in Vancouver, B.C. Vancouver is the sixth busiest cruise port in North America.

Table 5 includes cruise facilities (number of berths (berths), total length of berths (length), and depth alongside (depth)); type of service (embarkation/disembarkation (E/D), port-of-call visits (PC), or one-day cruises (1D)) and the number of passengers served each year for the past five years. Note that passengers are counted twice for embarkation and disembarkation (including for one-day cruises), but only once for visits at ports-of-call.

Table 5
U.S. Cruise Ports

	Port Facilities			Type of Service			Number of Passengers ²				
	Berths	Length ¹	Depth ¹	E/D	PC	1D	1992	1993	1994	1995	1996
Miami, FL	12	8,400	25-38	X		X	3100	3200	3000	3000	3000
Port Everglades, FL	10	NA	38-43	X		X	2300	2300	2400	2200	2100
San Juan, PR	9	NA	19-35	X	X		2300	1900	1900	1900	2000
Port Canaveral, FL	6	3,310	35	X		X	1100	1200	969	938	1100
Los Angeles, CA	4	2,840	37	X			889	850	817	846	954
New York, NY	5	NA	NA	X			311	427	461	400	465
Juneau, AK	2	2,000	30		X		268	305	360	407	462
Ketchikan, AK	3	2,250	35-50		X		263	319	379	380	400
Key West, FL	3	1,400	31		X		140	380	450	398	393
Skagway, AK	3	3,850	35-42		X		151	194	203	253	300
Sitka, AK	2	650	18-50		X		178	192	192	162	238
Tampa, FL	4	2,800	34	X	X		77	218	304	276	225
Palm Beach, FL	2	1,310	25-33	X		X	341	330	249	256	322
New Orleans, LA	2	2,500	34+	X			66	70	91	129	153
Honolulu, HI	3	1,600	35	X	X		143	191	145	142	126
Manatee, FL	6	4,600	40	X			NA	64	64	64	100
Haines, AK	2	1,600	38-48		X		20	25	49	75	93
Valdez, AK	2	1,300	26-56		X		28	28	57	62	78
Boston, MA	5	3,000	32-35	X	X		29	31	75	60	67
Wrangell, AK	1	740	36		X		70	55	70	55	65
San Francisco, CA	2	1,800	35	X	X		47	43	56	66	53
Philadelphia, PA	2	1,800	33	X			8	14	4	6	47
Whittier, AK	1	1,100	30		X		78	25	NA	32	40

Table 5
U.S. Cruise Ports

	Port Facilities			Type of Service			Number of Passengers ²				
	Berths	Length ¹	Depth ¹	E/D	PC	1D	1992	1993	1994	1995	1996
Portland, ME	1	720	36		X		13	11	11	9	24
San Diego, CA	4	4,000	35	X			460	326	263	35	21
Charleston, SC	1	NA	35-40		X		21	13	14	11	14
Seattle, WA	3	NA	35	X	X		5	6	2	8	10
Baltimore, MD	3	NA	34	X			12	12	14	13	7
Anchorage, AK	3	2,220	35		X		4	4	3	4	7
Dutch Harbor, AK	2	1,250	40		X		1	NA	NA	3	4
Galveston, TX	2	1,400	30	X			1	4	191	4	3
Homer, AK	2	NA	40		X		15	NA	NA	4	3
Gulfport, MS	NA	NA	NA	X			55	500	0	2	0
St. Petersburg, FL	NA	NA	NA	X			2	5	NA	22	0
Petersburg, AK	3	800	23		X		6	NA	NA	NA	NA

Source: *International Guide to the Cruise Industry: 1997 Annual*, Cruise Industry News.

NA - not available

¹ in feet

² in thousands

Shipbuilding and Repair

At the time of this study, 24 deep draft cruise ships were on order or under construction for the U.S. fleet. With an average cost per vessel of over three hundred million dollars each, the total investment in new cruise ships is more than 7.5 billion dollars. Construction of the ships is concentrated in four shipyards: Kvaerner Masa-Yards in Finland, Chantiers de l'Atlantique in France, Meyer Werft in Germany, and Fincantieri in Italy. The concentration of new buildings in those shipyards is attributed to their expertise, an abundance of experienced local suppliers and subcontractors, subsidies, and favorable financing arrangements (*International Guide to the Cruise Industry: 1997 Annual*, Cruise Industry News, p. 151).

An important factor in the selection of a repair facility is its proximity to a vessel's sailing area. Cruise ships spend as little time as possible being repaired. Since most of the cruise ships sail in or North America, most cruise ship drydocking and repairs are done in North American shipyards. Shipyards that have completed major cruise ship servicing include Atlantic Marine and Bender Shipbuilding in Mobile, Cascade General - Portland Shipyard in Oregon, Newport News and Norfolk Shipbuilding in Virginia, Todd Pacific in Seattle, and Vancouver Shipyards in British Columbia (*Cruise Industry News Quarterly*, Fall 1997, pp. 52-55).

IV. CRUISE OPERATIONS

Aspects of cruise operations that can significantly affect NED benefits include itinerary planning and port selection, contingency planning, operating costs and revenue generation.

Itinerary Planning and Port Selection

Cruise operations rely on the successful marketing cruise services offered. According to cruise line officials interviewed for this study, itinerary planning is critical for cruise lines since the destinations offered are key selling points. In choosing a particular cruise, passengers are influenced by the inclusion of a particular port or ports, the number of days at sea versus time in port, the number of port calls and other characteristics of the itinerary.

Cruise lines typically perform itinerary planning 18-24 months before a cruise. Of the various factors that influence itinerary planning, the marketability of the itinerary is most important to the cruise lines. Other important factors include port accessibility, costs, berth congestion, the behavior of competitors, and the line's experience with previous cruises. Once itineraries have been approved and brochures published, changes are rarely made by the cruise line. A ship sale or mechanical failure, security threat or exceptional weather conditions may force a change in itinerary.

Various factors influence the selection of particular ports included on an itinerary. For turnaround ports (ports where passengers begin and end cruises), proximity to regional source markets and cruise lines' previous experiences with quick and efficient passenger embarkation and disembarkation are most important. Landward access is a critical factor, and the port facilities are an important element of the transportation infrastructure. Seaward access is also important but is not a major consideration in most U.S. ports where the width and depth of approach channels, the length of turning basins and other navigational facilities are seen as adequate by the cruise lines. For destination ports (ports that passengers go to while on the cruise), marketability is paramount to the lines and may outweigh any operational problems or added costs. However, cruise lines display risk adverse behavior because of the substantial costs that can result from operational problems.

Cruise lines have experienced specific operating problems in some U.S. ports, including Houston, New Orleans, Baltimore, and Philadelphia. In New Orleans, cruise line officials see an eight-hour passage on a river with navigation impeded by fog as a major disadvantage. Houston is another port hampered in this way, although cruise line officials do not consider Houston an attractive destination. On the northeastern seaboard, cruise lines see Baltimore and Philadelphia as very attractive ports from a marketing standpoint, but both are hindered by long river passages and, in Philadelphia, restricted air draft. Long-river passages are generally avoided by the major cruise lines not only because of the additional costs incurred, including pilotage, but also because of the disproportionate time needed to fit them into the busy schedule.

The cruise lines recognize that the new era of mega cruise ships is presenting new challenges to ports alongside post-panamax container ships, but the sophistication of equipment is giving the new cruise ships much greater maneuverability and independence.

Contingency Planning

Cruise service disruptions can be very costly. As a precaution, all cruise lines interviewed have contingency plans in place that are exercised if an incident occurs. They commit considerable resources to contingency planning since operating problems can cause additional costs, lost revenues, and a damaged reputation. Usually, a standard contingency plan is used setting out who does what, when, in the shore-based and shipboard organizations. However, specific plans are prepared for ports considered posing a greater threat of disruption due to operating constraints.

The interviewees revealed that major service disruptions were infrequent in part due to thorough port planning and the operational capabilities of the tonnage deployed. Table 6 lists eight incidents or recurrent operational difficulties that cruise lines see as serious due to their impact on costs and revenues. Note that two of these problems did not occur at U.S. ports (Montreal, Canada and Wilhelmsted, Curacao), and many other difficulties could not be reduced

Table 6
Port-Related Operational Problems

Cruise Line	Port	Comment
Holland America Line	Ft. Lauderdale	Incident where bad weather prevented port entry forcing rerouting to Miami to conduct delayed turnaround operation
	Montreal	Incident of delayed turnaround due to suspected Legionnaires' disease on board vessel
Princess Cruises	New Orleans	Delays due to fog
	St. Thomas	Incident of delayed entry resulting in delayed turnaround operation at St. Juan
Royal Caribbean Intl.	San Juan	Reported operational difficulties due to a narrow entrance channel
	Wilhelmsted	Incident of damage to ship due to strong winds and currents
Premier Cruises	Philadelphia	Incident of difficult berthing of a ship due to insufficient depth alongside a pier
Norwegian Cruise Line	Houston	Recurrent delays due to traffic congestion and fog in the Houston ship canal

Source: MSI

or eliminated by harbor improvements. Besides these eight, several other incidents of lesser impact were reported including operational problems in New Orleans, Baltimore, Philadelphia, Ft Lauderdale, St. Thomas, Key West, CocoCay (Bahamas), Sorrento (Italy), and Anchorage.

Disruption to a turnaround port results in considerable logistical problems. Substantial additional costs are incurred in rebooking flights, hotels, ground transportation, food and drink and the employment of extra staff to cope with disrupted passenger flows that can involve several thousand people. Comments made by one line interviewed confirmed that no effort is spared to look after customers in case of a delayed or disrupted cruise because of the potential damage that this can do to the cruise line's reputation. Common practice in the cruise industry is to offer passengers full refunds and free or heavily discounted tickets for future cruises.

Besides contingency planning to cater for problems as and when they arise, the cruise lines build in operating margins in ship scheduling as a preventive measure. The greatest margins are made for older ships working demanding cruise itineraries. For example, steamships may keep one boiler idle, which can be used in case of emergency or delay. Margins are smaller for modern tonnage equipped with sophisticated propulsion and maneuvering equipment that enable ships to make up for lost time.

Operating Costs

Operating cost are important to the cruise industry because they affect profitability. The cruise lines surveyed were reluctant to reveal information on operating costs. Therefore, Maritime Strategies International (MSI) derived information on variable operating costs from various unnamed industry sources. MSI also uses unnamed industry sources to develop the vessel operating costs that are published by IWR. However, the cruise vessels costs used in this report were not developed using the same methods as those used to develop the published costs. In addition, these costs are not comparable to the published costs since they do not include capital costs (i.e. replacement). Finally, operating costs of cruise vessels vary greatly and should be estimated on a case-by-case basis. Therefore, costs presented below are in percentages and are simply intended to provide a clearer idea of the general cost structures for some cruise vessel types.

Table 7 presents operating cost structures for four vessel types for which information was made available. This comparison shows the relative significance of the main cost elements and, in particular, the prominence of crew costs. Crews are typically paid monthly according to an agreed number of hours worked per day with a payment for overtime.

Port officials stated that in case of a serious, port-related operational problem, port expenses and bunkers are the most affected. Ship-related costs rise because of lengthier stays, overtime payments, etc. Bunkering expenses increase because of the faster speeds needed (and, therefore, heavier fuel consumption) to catch up on delays. Other cost areas affected by service disruptions include stevedoring and tugs.

Table 7
Comparison of Annualized Variable Operating Costs
For Some Cruise Vessel Types

Element	Vessel "A"	Vessel "B"	Vessel "C"	Vessel "D"
Passenger food & beverage	15.2%	13.9%	23.3%	18.5%
Port expenses	12.9%	10.1%	25.6%	12.9%
Bunkers	12.3%	9.3%	10.3%	12.8%
Insurance	2.4%	8.9%	N/A	N/A
Crew	29.7%	27.5%	22.7%	32.1%
Consumables	19.1%	17.3%	11.4%	17.5%
Other	8.3%	13.0%	6.7%	6.2%
Total	100.0%	100.0%	100.0%	100.0%

SOURCE: MSI

N/A: not available

"A" = 1,250 passenger premium category

"B" = 750 passenger luxury

"C" = 1,100 passenger contemporary

"D" = 750 passenger budget

Revenue Generation

The cruise lines were also reluctant to disclose information regarding revenue structure, which they consider to be commercially sensitive. Therefore, MSI developed revenue breakouts from other sources. Some lines, however, confirmed that onboard revenues had increased significantly in recent years with the development of long established and new revenue generating outlets including health and fitness centers. The potential for further significant increases, however, is seen, overall, as limited, particularly as the trend is toward all-inclusive pricing, with passenger fares including all drinks, shore excursions, tips and most onboard services.

Table 8 provides a comparison of vessel revenue structures in percentage terms for various vessel types. The main elements of revenues are passenger fares, onboard revenue, and port taxes. Many ports charge passenger taxes of about five to eight dollars per passenger to pay for land side passenger services and facilities. Most cruise lines collect these fees from passengers.

The impact of service disruption on the principal revenue stream, passenger fares, is minor because partial or full refunds are very rare. However, onboard revenue sources can be severely disrupted. Service disruptions can have a very serious impact on revenue derived from shore excursions if excursions are curtailed or canceled due to delays or other problems. This

Table 8
Cruise Vessel Revenue Structures

Element	Vessel "A"	Vessel "B"	Vessel "C"	Vessel "D"
Passenger Fares	85%	87%	65%	66%
Shore Excursion	3.9%	2%	N/A	N/A
Bar	3.3%	8%		
Casino	1.6%			
Shops	3.1%			
Other	1.1%			
Onboard Revenue total	13%	10%	35%	34%
Port Taxes	2%	3%	N/A	N/A
Total	100%	100%	100%	100%

SOURCE: MSI

N/A: not available

"A" = 1250 pax premium category - Alaska trading

"B" = 750 pax luxury category - Worldwide trading

"C" = 1100 pax contemporary category

"D" = 750 pax budget category

can have a ripple affect on revenue from later shore excursions because passengers could be less likely to book another shore excursion in the light of a previous bad experience. Bar, casino and shop revenues can also be affected in the same way, especially where disruption limits opening hours. However, most cruise line officials indicated that these revenues are not significantly affected by disruptions.

Passenger Satisfaction

In a marketing driven business such as cruise shipping, the understanding of what customers want and how the company is performing compared with their expectations are important priorities. Officials from all five cruise lines interviewed said that they committed considerable resources to gauging passenger satisfaction levels through comment cards and questionnaires. Typically these are handed out before the end of each cruise and the completed cards collected and analyzed as soon as possible.

All aspects of the cruise experience are examined from the time that the passengers leave home to the time they return. Passenger experience with airlift, ground handling, meet and greet staff, and pre- and post-cruise is examined. The most important area is onboard product delivery, the key elements of which are food, dining room service and hotel service. Seaward access is not an important consideration in passenger satisfaction surveys although adverse

comments are received if operational problems delay or prevent port entry. The number of comments received depends on the severity of the problems encountered and passenger awareness.

Overall, the lines adopt a sophisticated approach to passenger satisfaction. Emphasis is placed on detail, the speed of feedback, and the ability to carry out corrective action within a short time. Commonly, the survey and analysis of passenger satisfaction levels are performed entirely in-house.

V. POTENTIAL NED BENEFITS

Benefits associated with cruise ships from harbor improvements could accrue from three sources: 1) existing vessels using a harbor under without-project conditions operate more efficiently in that same harbor under with-project conditions; 2) vessels using one harbor under without-project conditions transfer to the improved harbor under with-project conditions; and 3) new vessels (larger, with more amenities) begin using a harbor under with-project conditions that they did not use under without-project conditions. Benefits could accrue to both vessel operators and passengers under each of the three scenarios. Note that under Section 230 of the *Water Resources Development Act of 1996*, benefits accruing to both passengers and operators are categorized as commercial navigation benefits. Table 9 summarizes the benefits that could accrue under each scenario for both benefiting groups.

As with most benefit analyses, one primary difficulty will be identifying the with- and without-project conditions. The following discussion of potential benefits summarizes some likely issues. It addresses whether the benefits would be likely in turnaround or destination ports (or both), and their potential significance, both in magnitude and frequency. Methods for calculating the benefits are also suggested.

Existing Vessel Efficiencies

Existing vessel efficiencies would occur if existing cruise vessels using a harbor under without-project conditions operate more efficiently in that same harbor under with-project conditions. Note that significant inefficiencies such as regular delays are not likely in most U.S. ports used by cruise ships. The width and depth of approach channels, the length of turning basins and other navigational facilities at most U.S. ports currently used by cruise lines are generally adequate for cruise vessels. In addition, most U.S. ports are used as turnaround ports where passengers embark and disembark. Due to the tight fixed schedules that cruise ships adhere to for turnaround ports, and the significant costs in disrupting that schedule, the cruise lines do not tolerate regular delays.

TABLE 9
Potential Benefits Associated with Cruise Ships

Source of Benefit	Potential Benefits to Operators	Potential Benefits to Passengers
1. Improved Vessel Efficiencies	<p>Decrease in operating costs</p> <p>Increase in producer surplus from fewer canceled shore excursions</p> <p>Increase in producer surplus from higher onboard revenue</p> <p>Decrease in landside costs (meals, hotels, transportation, staff)</p> <p>Decrease in payments to passengers (refunds and/or free cruises)</p>	<p>Change in value of experience: - increase due to reduction in canceled shore excursions & irritation/stress - decrease due to loss of extra time on ship</p> <p>Decrease in opportunity costs of time</p> <p>Reduction in out-of-pocket costs</p>
2. Change in Port Routings (Origin or Destination)	<p>Same as above, plus . . .</p> <p>Increase in producer surplus from higher fares and/or new passengers</p>	<p>Same as above, plus . . .</p> <p>Increase in value of experience at new port</p> <p>New passengers' consumer surplus</p> <p>Change in costs of transportation to port</p>
3. Induced Vessels	<p>Same as above</p>	<p>Same as above, plus . . .</p> <p>Increase in value of experience with new vessel</p>

However, existing cruise vessels are subject to some inefficiencies that harbor improvements could relieve. For example, delays in the Houston Ship Channel due to congestion could be reduced by passing lanes. Operating difficulties in the San Juan entrance channel may be reduced by channel improvements (improvements to the channel are under construction). In Ft. Lauderdale, reversing into a berth and vacating if a containership must pass could also be eliminated by widening. Tendering operations (using a small boat to transfer passengers from the ship to shore and back) could be eliminated or made safer and more reliable with harbor improvements.

Benefits to Operators

Benefits to operators of cruise vessels could include decreases in operating costs; increases in producer surplus from fewer canceled shore excursions and higher onboard revenue; decreases in landside costs such as meals, hotels, transportation, and staff; and decreases in payments to passengers such as refunds and/or free cruises.

Reduction in operating costs can benefit existing cruise operations at both turnaround and destination ports. Operating efficiencies may reduce vessel operating costs, as well as costs for tenders, tugs, pilots, stevedores, etc. The incremental cost reductions can be calculated using the same techniques used for other types of commercial vessels. Reductions in vessel operating costs are generally calculated as time savings multiplied by a per unit cost. Unfortunately, vessel operating costs for cruise ships are significantly different from costs for other types of commercial vessels and can vary greatly depending upon ship size and type. Hence, vessel operating costs should be estimated on a case-by-case basis. Reductions in costs for tenders, tugs, pilots, stevedores and other assistance are calculated using the difference between the costs under with and without project conditions. Additional information on calculating reductions in operating costs can be found in *Planning Guidance Notebook ER 1105-2-100; Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G)*; and the *National Economic Development Procedures Manual: Deep Draft Navigation*.

Increase in producer surplus (profits) may be an important benefit category, particularly for destination ports. When vessel arrivals are delayed, shore excursions may be canceled. Shore excursions are one of the largest sources of onboard revenue for cruise vessels. Cancellation of shore excursions in the beginning of a voyage can seriously affect revenues from later shore excursions since passengers will be less likely to book additional excursions. Harbor improvements could mitigate such problems and the increase in producer surplus could be calculated as the additional profits resulting from fewer canceled excursions in a given year.

Harbor improvements are not likely to affect profits from the bars, shops, or casinos, other major sources of onboard revenues. According to officials with the cruise lines, delays and other disruptions do not affect revenues or profits for these operations. Passengers tend to allocate a certain amount of money for these types of purchases and do not change the amount they spend in the case of disruption or delay.

Reduction in landside costs or payments to passengers is not likely to be a significant benefit to existing cruise vessels. The types of problems that cause these costs are usually related to severe weather conditions, such as hurricanes, and are not likely to be affected by harbor improvements. In addition, they rarely occur, especially in U.S. ports. However, the costs of such incidents can be enormous.

With a serious delay at a turnaround port, incoming passengers would be put up in a hotel and meals provided. Outgoing passengers would require rescheduled flights, hotels, and meals. Payments to passengers including refunds of fares and/or free or reduced cost tickets for future fares could be provided. Baggage handling and ground transportation would be disrupted. If the ship were forced to switch ports, the logistical problems would multiply. Landside staff and crew would have to relocate to the alternative port and operate in an unfamiliar environment. Costs for ships' stores, bunkering, and port fees are all likely to increase significantly.

Benefits from reductions in landside costs can be determined using standard NED procedures (estimate the costs under with- and without-project conditions and calculate the difference). The calculation of benefits from reductions in payments to passengers should be considered a nonstandard procedure since the payments for future cruises must be reduced by the profits that the cruise lines would make from onboard revenue. Some payments to passengers also represent the reduction in consumer surplus due to delays or cancellations, counting both reductions in payments to passengers and the reduction in consumer surplus would result in double counting. Nonstandard procedures must be coordinated with CECW-PD.

Benefits to Passengers

Benefits to passengers may also accrue from improvements to harbors used by existing cruise vessels. In particular, their consumer surplus will increase if the value of their experience is enhanced and their willingness-to-pay increases. In addition, passengers may experience fewer out-of-pocket expenses and opportunity costs of time under with-project conditions. As mentioned above, these benefits would be classified as commercial navigation benefits.

Increase in the value of passenger experiences could occur from harbor improvements that reduce vessel inefficiencies, leading to an increase in willingness-to-pay and consumer surplus. However, note that the consensus of the interviewed cruise officials was that passengers do not notice vessel inefficiencies unless serious problems such as delays that affect destination port calls (and especially shore excursions) or flights home are experienced. Also, delays that increase the time that passengers remain on the vessel may increase some passengers' consumer surplus because they prefer being on the vessel rather than having the cruise end. Only delays returning to the turnaround port could have this impact.

Harbor improvements that enhance or eliminate tendering would increase consumer surplus. Tendering is more time-consuming and inconvenient for passengers than berthing and walking off the ship. As a result, they are less likely to leave the ship or participate in shore excursions. In addition, port calls are less likely to be canceled due to poor weather if the tendering is conducted in a protected location (for example, behind a breakwater) or if vessels can berth and not rely on tenders.

Changes in consumer surplus should be measured using the contingent value method (CVM), conjoint analysis, or unit day values developed specifically for cruise passengers. Unit day values for cruise ship recreation activities could be developed using a panel of experts. Conjoint analysis (or trade-off analysis) examines how people make choices for products or

services and can provide estimates of the value of the products or services. It is used extensively in marketing analyses and may be the best type of analysis currently available for evaluating the effects of changes in cruise operations. Development and application of the CVM, conjoint analysis, or cruise-specific unit day values would be difficult to implement. Conjoint analysis and application of the CVM to cruise ship passengers require surveys, which are time-consuming and expensive. They also would be new techniques for USACE analysts. Development of cruise-specific unit day values would be considered a nonstandard procedure, and would require coordination with CECW-PD.

Existing unit day values and the travel cost method are not recommended for calculating benefits to passengers. The *Planning Guidance Notebook* (ER 1105-2-100) restricts the use of unit day values, and implies that their use is not an economically sound or empirically defensible approach. In addition, they originally were based on activities such as fishing, camping, boating, and picnicking, with no consideration given to an activity like cruising. Procedurally, the existing unit day values could be applied, but is not recommended since their use would not yield meaningful results.

A travel cost model would also result in inaccurate results and is not recommended. One underlying principle of the travel cost method is that users consider the time and travel cost to participate as the major cost associated with that experience. Although some people pay several hundred dollars in air fares to get to and from the cruise homeport, that is a very small portion of the total cost of the cruise experience. A travel cost model could be statistically estimated, but extrapolating those values to net willingness to pay would not yield meaningful results.

Reductions in passenger opportunity costs of time and out-of-pocket expenses could accrue if delays returning to a turnaround port were reduced. Delays returning to a turnaround port can cause serious disruptions to passenger travel plans. They may be delayed in returning home and could experience increases in out-of-pocket expenses. The same caveats that apply to reductions in landside costs and payments to passengers also apply here. These types of delays are unlikely to occur regularly in U.S. ports, and are also unlikely to be caused by problems that can be solved with a Corps project. However, reductions in passenger opportunity costs of time and out-of-pocket expenses can be estimated using standard techniques. Note that reductions in passenger out-of-pocket expenses cannot duplicate benefits from reductions in passenger-related landside costs paid by the cruise lines.

Vessel Transfers

Benefits associated with cruise vessels could also accrue if with-project conditions enable vessels to transfer from one harbor to another. These types of benefits may occur for transfers between both destination and turnaround ports. Transfers of vessels among destination ports are frequently planned in the cruise industry. As the industry matures, one of the biggest needs appears to be new and different destination ports to attract repeat business and expand the market. Cruise lines constantly search for new destinations and develop new itineraries to meet the demands of their passengers. Small harbors that improve enough to allow easy access by a

cruise vessel may very well become a regular stop, particularly if the port is in a scenic or historic area. However, as mentioned previously, most U.S. ports already have adequate general navigation features for cruise vessels.

Cruise lines also occasionally shift turnaround ports. Landside access and infrastructure such as airports, ground transportation, hotels, terminals, etc. are very important for turnaround ports. Therefore, cruise lines switched them less frequently than destination ports. However, the cost savings for switching turnaround ports can be substantial. Since cruise operators are risk-averse, with-project conditions that forecast new ports, particularly turnaround ports, must be strongly supported.

Benefits to Operators

Benefits to operators of cruise vessels from switching harbors could include the same four categories described above: 1) decreases in vessel operating costs, 2) increases in producer surplus from higher onboard revenue, 3) decreases in landside costs, and 4) decreases in payments to passengers. These benefits would accrue if the vessel could operate more efficiently at the new harbor than its old one. For instance, the new turnaround port could be closer to the destinations than the original port, resulting in lower vessel operating costs. Increased operating efficiencies in the new harbor could also result in lower vessel costs. Delays on arrival at a new destination port could be less frequent, resulting in fewer canceled shore excursions and higher producer surplus. Finally, delays returning to the turnaround port could also be less frequent, resulting in lower landside costs and payments to passengers. These benefits are calculated as discussed above.

An increase in producer surplus could also occur if the transfer to a new harbor was attractive enough to cruisers that it induced new users to cruise or enabled the cruise line to raise fares. The increased producer surplus from the additional profits from the new users and increased fares is also a benefit. New users could be induced to cruise, also increasing producer surplus, if the vessel efficiencies at the new port enabled the cruise line to lower fares, and reduced the cost to passengers.

Note that transfers to new harbors could result in increases in some costs. For instance, a new harbor may offer fewer delays, lower landside costs, and greater producer surplus because of an ability to increase fares due to greater desirability of the port, but the new port could also involve increased travel distances, resulting in higher vessel operating costs. Many combinations of increased and decreased costs or producer surplus could occur when vessels transfer harbors. Therefore, all cost categories should be considered in the benefit analysis, and all significant changes in costs calculated.

Benefits to Passengers

Benefits to passengers could include the same categories discussed in the section on existing vessel efficiencies. These categories are 1) change in the value of experience (increases due to reduction in canceled port calls, shore excursions, and irritation and stress, or decreases due to the loss of extra time on ship); 2) decrease in opportunity costs of time; and 3) reduction in out-of-pocket costs. These benefits could accrue if service disruptions in the new port were less frequent than in the old port.

Consumer surplus could also increase if the new port provides a higher value experience to existing passengers. As discussed above, producer surplus could result to cruise operators by capturing some of the passengers' increased willingness to pay through higher fares. Calculating both the consumer and producer surplus could result in double counting. To avoid this, the increase in fares could be subtracted from the passengers' consumer surplus estimates, or the fare increase could be part of the description of the good in the contingent value or conjoint questionnaire. Consumer surplus for new users could also be a benefit.

Changes in the costs of transportation to and from a new turnaround port could also be an effect of vessel transfers. Note that this could result in either lower out-of-pocket costs for passengers who pay for their own flights or a decrease in costs for the cruise line.

New Vessels

Harbor improvements can also enable newly constructed larger vessels (or larger vessels that do not call the U.S) to begin calling. The cruise industry is in the midst of a new building boom, with many of the new vessels planned for the North American market. Most of the vessels being constructed will be among the largest vessels in the existing cruise fleet. For example, Royal Caribbean International has three vessels on order that, when complete, will be the largest cruise vessels in the world. The Project Eagle vessels are 142,000 gross tons, 1,018 feet long and 157 feet wide. They will draft less than 30 feet. (In comparison, the *Regina Maersk*, the 6,000 TEU containership that made news when it called at U.S. East coast ports in the summer of 1998, is 1,043 feet long, 137 feet wide, and has a design draft of 46 feet).

Benefits to Operators

Benefits to operators will include all those discussed previously. For new vessels, it is likely that economies of scale - decreases in vessel operating costs - will comprise an important benefit category. Benefits in this category can be calculated as the transportation cost savings resulting from the use of the new vessel. Taking the difference between transportation costs per unit under the without- and the transportation costs per unit under the with-project conditions and multiplying by the vessel load would yield the total transportation savings per movement.

Benefits to Passengers

Benefits to passengers will also include all those discussed previously. In addition, increases in consumer surplus due to enhancements in the recreational experience of being on a new, larger vessel with more amenities may also accrue.

VI. SUMMARY OF ISSUES

Benefits to Vessel Operators

Cruise ship operators do not experience significant operating inefficiencies or severe service disruptions in most U.S. ports. Although cruise vessels can be extremely long and wide, they are not as deep as other commercial vessels and are usually not constrained by channel depth. Their maneuverability makes them less sensitive than other vessel types to channel width and turning basin size. The inefficiencies and disruptions that do occur in cruise operations are generally not caused by problems that USACE navigation projects can solve. For example, long river passages or entrance channels such as those serving Houston, New Orleans, Baltimore, and Philadelphia cannot be efficiently shortened. Delays due to severe weather conditions such as hurricanes cannot be eliminated by navigation improvements. Finally, constraints due to inadequate berth depths are not a Federal responsibility. These factors minimize the opportunities for navigation improvements to benefit cruise vessel operators.

Benefits to Passengers

The same factors that minimize the potential benefits to cruise vessel operators also reduce the benefits to cruise passengers. In addition, passengers are not as sensitive to delays and other disruptions as operators are. Unless a service disruption is severe enough to cause passengers to miss shore excursions or flights home, they tend not to notice or be affected.

Calculation of Benefits

The calculation of benefits from changes in cruise operations raises many issues. As with most benefit analyses, one primary difficulty in evaluating the benefits accruing to cruise vessels from navigation improvements will be identifying the with- and without-project conditions. Changes in vessel operations and the resulting impacts on costs, revenues, and consumer surplus must be carefully identified and supported. Care must be taken to ensure double counting of benefits does not occur, especially when the same benefits (such as reductions in transportation costs to the turnaround port) are accrued by both vessel operators

and passengers. Vessel operating costs (and other costs) should be estimated on a case-by-case basis. Changes in consumer surplus should be calculated using a contingent value method or conjoint analysis, which have not been applied previously to cruise studies. Data acquisition will require questionnaires (expensive and time-consuming), and the techniques will be difficult to apply.

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